Test and Evaluation/ Science and Technology (T&E/S&T) Program

6th Annual Science & Engineering Technology Conference 19-21 April 2005

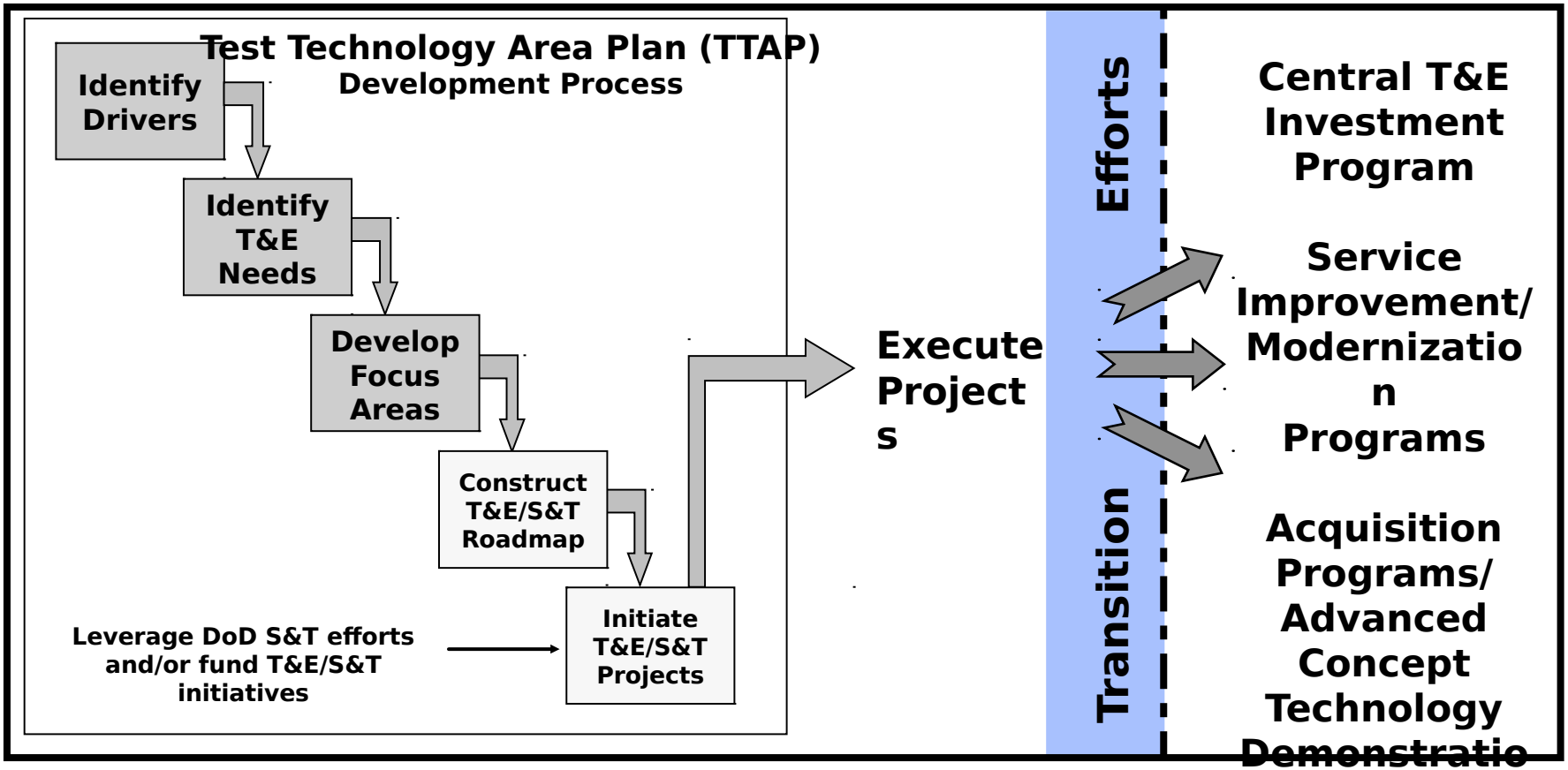
George Rumford
T&E/S&T Program Manager
DTRMC
(703) 681-4166 x 125

T&E/S&T Program
Background

- **Program started in FY 2002**
  - Joint DDR&E/DOT&E initiative
  - Transitioned to DTRMC in Feb 2005
- **Mission**
  - *Develop new technologies required to test and evaluate our transforming military capabilities*
    - *Includes any system that makes our warfighters more survivable and effective in combat*
      - *Lethal and non-lethal weapons*
      - *Intelligence surveillance and reconnaissance*
      - *Information systems*
- **Goal**

  Transition emerging technologies into test capabilities in time to verify warfighting performance

T&E/S&T Program Process



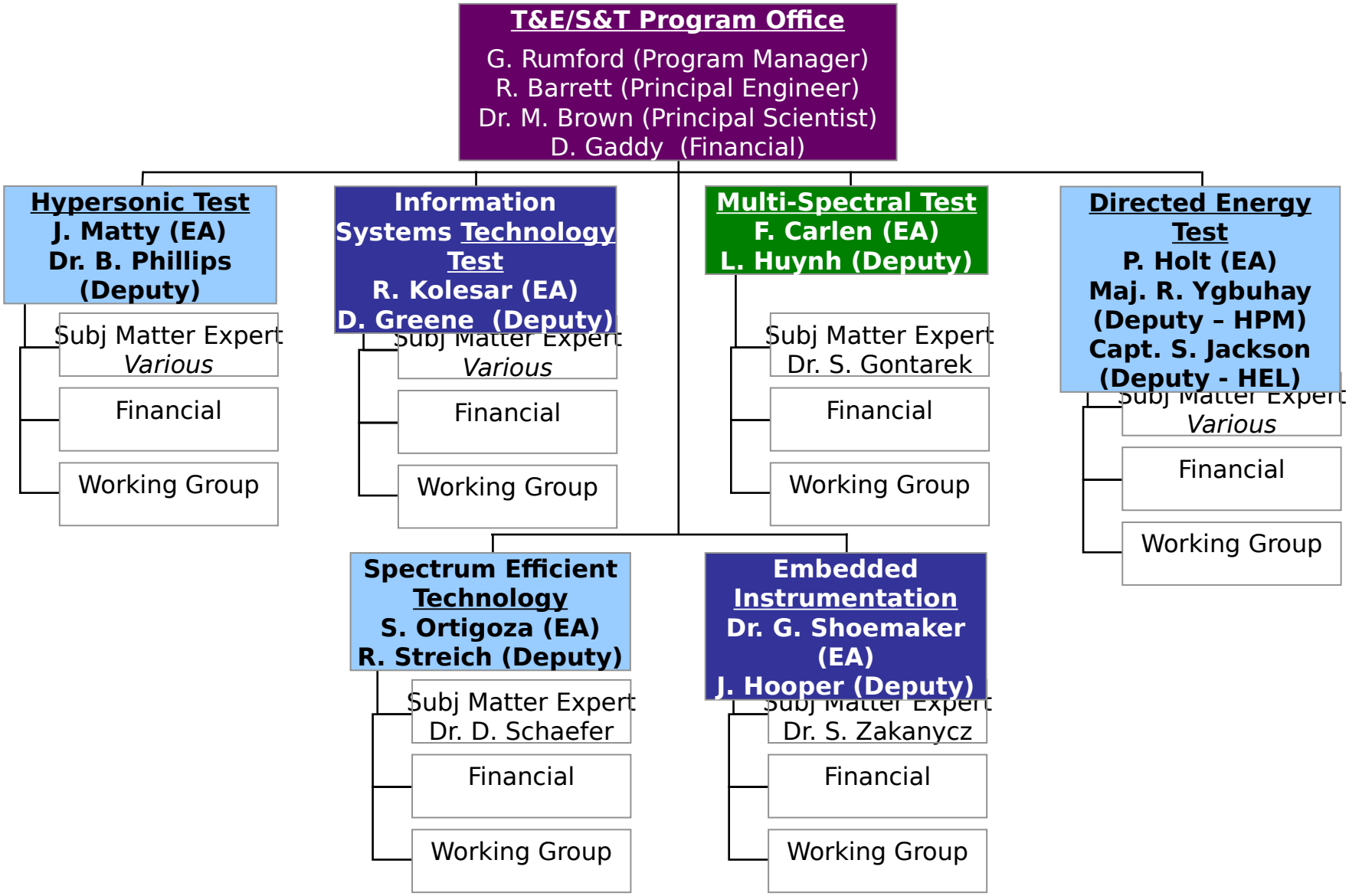
- Process used to identify focus areas
  - 9 focus areas identified
  - 6 currently active

T&E/S&T Program
Active Focus Areas

Test Technologies for

- **Emerging Warfighting Capabilities**
  - Hypersonic Vehicles
  - Directed Energy Weapons
  - Multi-Spectral / Hyper-Spectral Sensors
  - Net-Centric Warfare Systems
- **Enhanced Test Capabilities**
  - Spectrum Efficient Instrumentation Systems
  - Embedded Instrumentation

T&E/S&T Program Structure



T&E/S&T Program
Focus Area Start Up Plan

FY02

Hypersonic Test – T&E of air breathing hypersonic systems Mach 5 and above

Spectrum Efficient Technology – T&E telemetry using more efficient modulation techniques and spectrum augmentation technology

Multi-Spectral Test – Real time, realistic end-to-end T&E of multi-spectral and hyperspectral battlefield systems

FY03

Embedded Instrumentation – Technology for continuous and non-obtrusive T&E

Directed Energy Test – T&E of High Energy Laser and High Power Microwave systems

FY04

- *Mature and expand FY02 and FY03 focus areas*
- *Prepare to stand-up FY05 focus area*

FY05

Information Systems Technology Test – T&E of information systems within complex network-centric environment

FY06

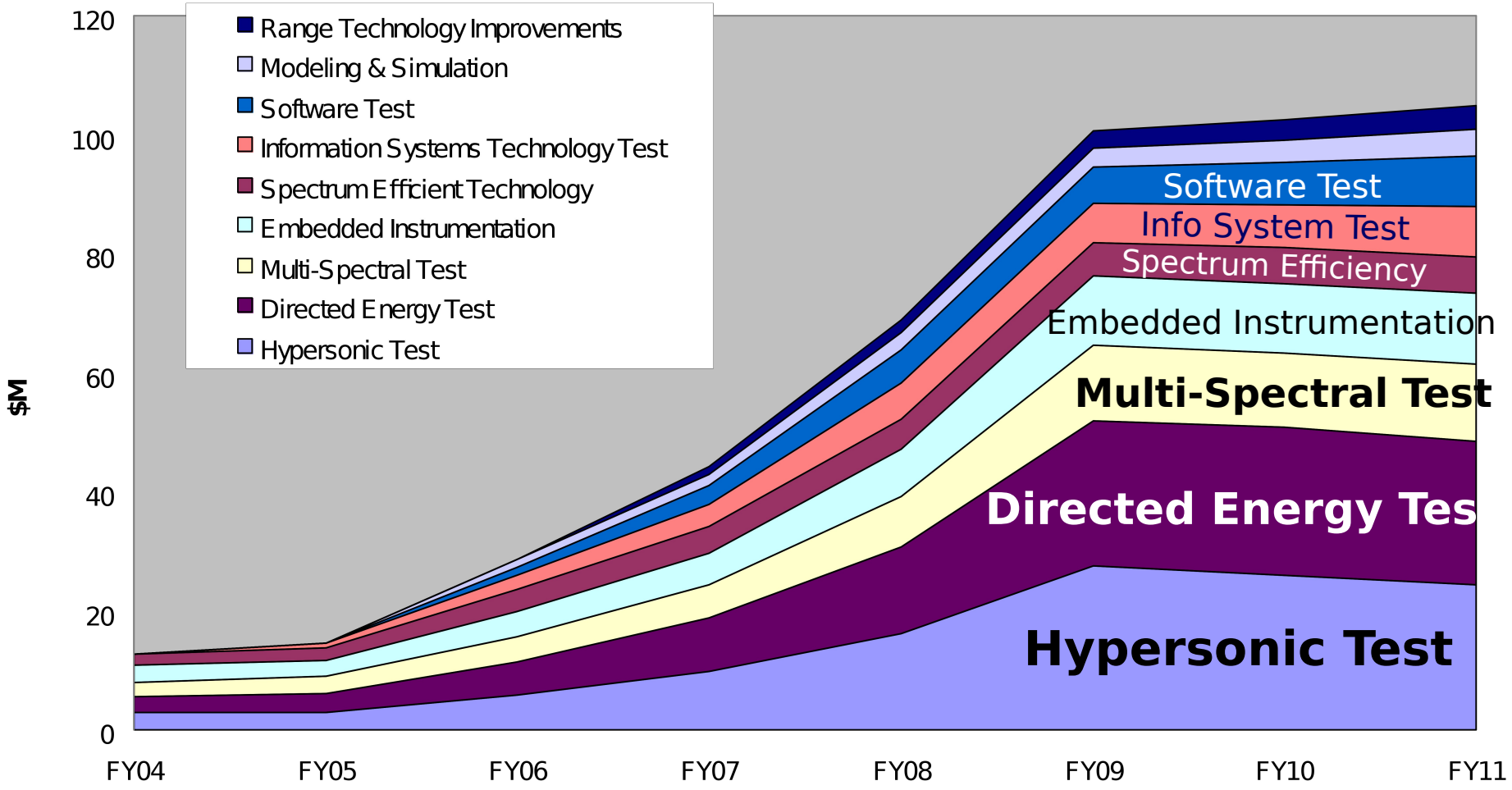
Software Test – T&E of software-intensive systems and cognitive systems

Modeling and Simulation – Advanced M&S capabilities that support test planning and T&E

FY07

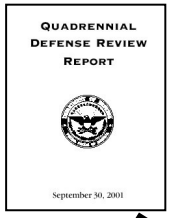
Test Range/Facility Technology Improvements – Enhanced data collection, management, and after action report capabilities

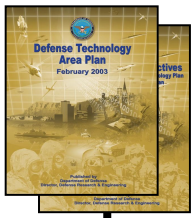
FY 2004 – FY2011
Funding by Test Technology Focus Area

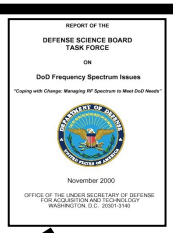


$12.8 M	$14.7 M	$29M	$44M	$69M	$101 M	$103 M	$105 M

T&E/S&T Program
Project Selection Process





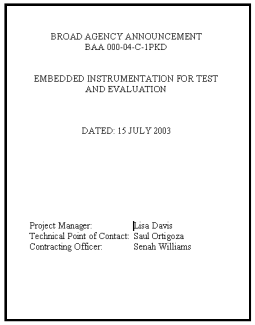


Solicitations are issued through http://www.fedbizopps.gov

Tri-Service Focus Area Working Group

- Executing Agent
- T&E Community Reps
- S&T Community Reps
- Subject Matter Experts

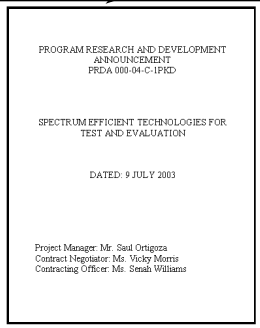
Needs/Requirements


BROAD AGENCY ANNOUNCEMENT
BAA 000-04-C-1PKD

EMBEDDED INSTRUMENTATION FOR TEST AND EVALUATION

DATED: 15 JULY 2003

Project Manager: Lara Davis
Technical Point of Contact: Saul Ortigoza
Contracting Officer: Senah Williams

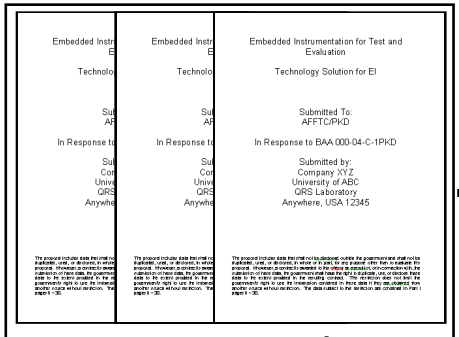

PROGRAM RESEARCH AND DEVELOPMENT ANNOUNCEMENT
PRDA 000-04-C-1PKD

SPECTRUM EFFICIENT TECHNOLOGIES FOR TEST AND EVALUATION

DATED: 9 JULY 2003

Project Manager: Mr. Saul Ortigoza
Contract Negotiator: Ms. Vicky Morris
Contracting Officer: Ms. Senah Williams

Solicitations


Embedded Instrumentation for Test and Evaluation

Technology Solution for EI

Submitted To:
AFFTC/PKD

In Response to BAA 000-04-C-1PKD

Submitted by:
Company XYZ
University of ABC
QRS Laboratory
Anywhere, USA 12345

Proposals

Source Selection Evaluation Team

- Working Group
- Subject Matter Experts
- Contracting Reps

Recommendations

Executing Agent

Final Selections

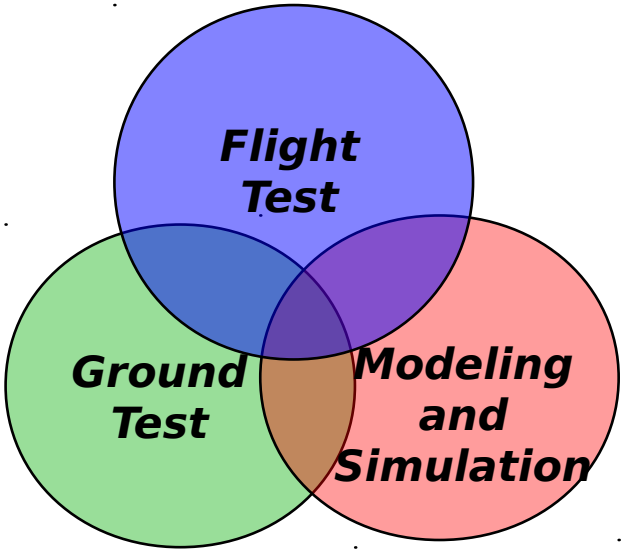
Program Manager

Funding Decision

Focus Area Execution

T&E/S&T Program
Hypersonic Test Focus Area

- **Hypersonic technology potential for rapid, long range targeting**
- **DoD hypersonic research efforts slated to transition technology to hypersonic weapon systems 2010+ timeframe**
  - National Aerospace Initiative
  - DARPA/Navy HyFly
  - Air Force Single Engine Demonstrator
- **Existing infrastructure inadequate to test envisioned systems**
  - Lead time away from meeting T&E needs
- **Need new T&E capabilities**
  - Ground test
  - Flight test
  - Modeling and Simulation
- **Supports T&E within DDR&E National Aerospace Initiative:**
  - High Speed/Hypersonics
  - Space Access
- **10 active projects**



Hypersonic Aeropropulsion System Flight Trajectory T&E

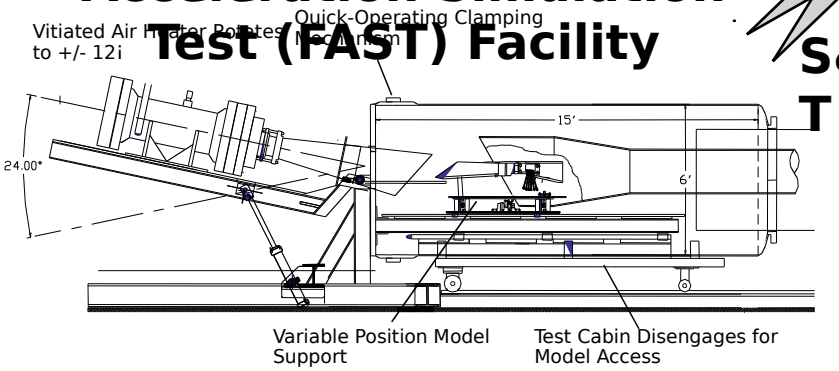
Developing the technical foundation required to incorporate variable Mach number test capabilities into Arnold Engineering and Development Center's Aerodynamic and Propulsion Test Unit (APTU) test facility

T&E

APTU Test Facility

S&T

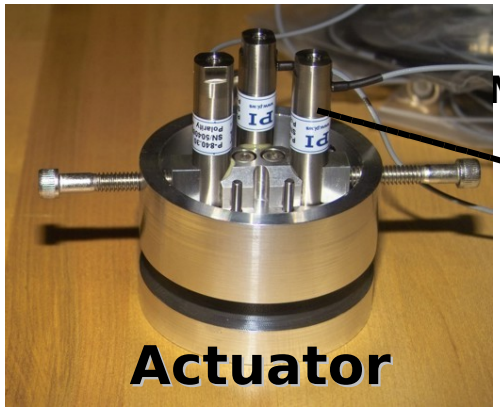
ATK GASL Flight Acceleration Simulation Test (FAST) Facility



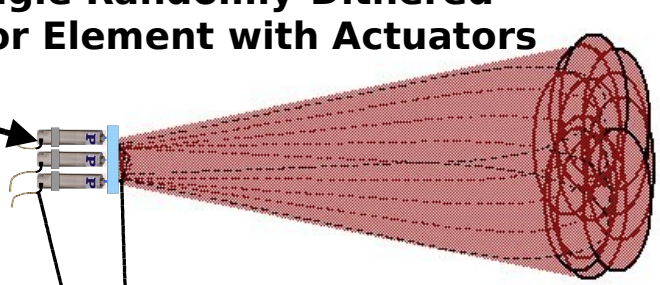
T&E/S&T Program
Directed Energy (DE) Test Focus Area

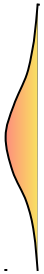
- **DE is revolutionary/transformational**
  - Focus has been on developing DE technologies, not how to test DE
  - Very little DE T&E legacy exists (infrastructure, methodology, expertise)
- **Need test technologies for:**
  - Survivable on-board instrumentation required to measure the DE beam on the target
  - Measuring the effects of DE on the target
  - Instrumentation that minimizes impacts on target performance and signature
  - Instrumentation to determine performance margins and reasons for success and failure
  - Evidence of the degree of hard kill and soft kill
  - Far field simulations in near field conditions
- **Supports T&E within DDR&E Initiative: Energy and Power Technologies**
  - Power sources for DE weapons
- **10 active projects**

Beam Redistribution System

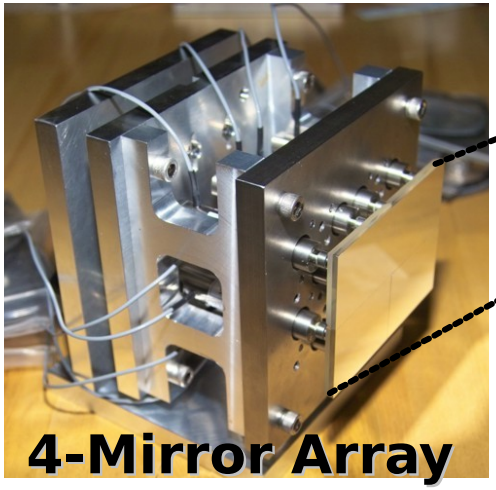


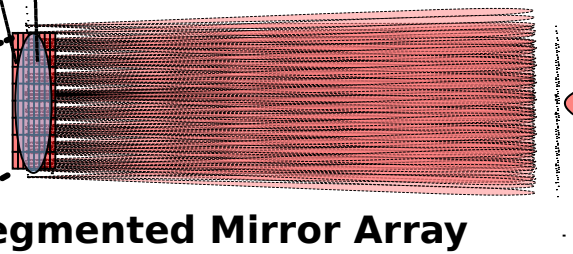
Single Randomly-Dithered Mirror Element with Actuators



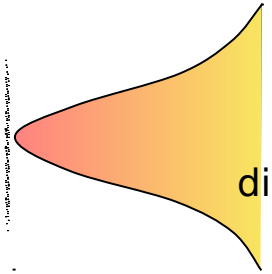


Time integral of single dithered beamlet





Segmented Mirror Array



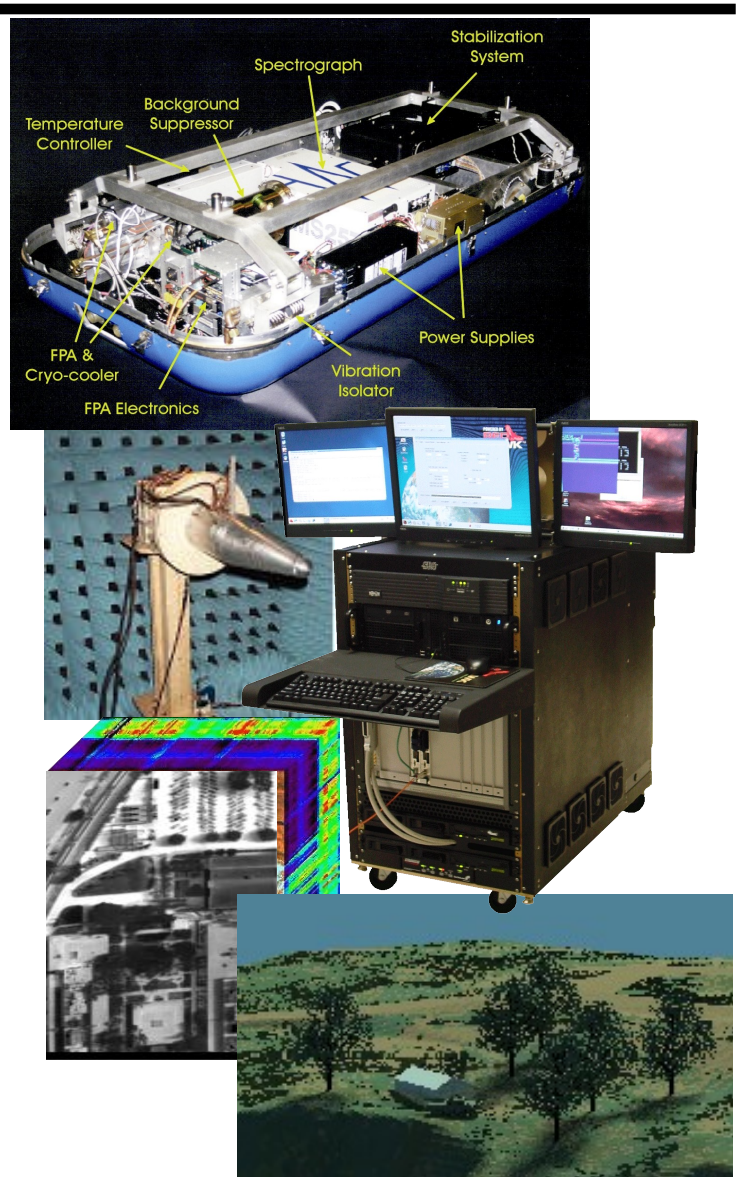
Time integral of multiple dithered beamlets

Array is composed of individual randomly dithered mirrors. Multiple mirrors can achieve integration times that are short compared with the target thermal time constant.

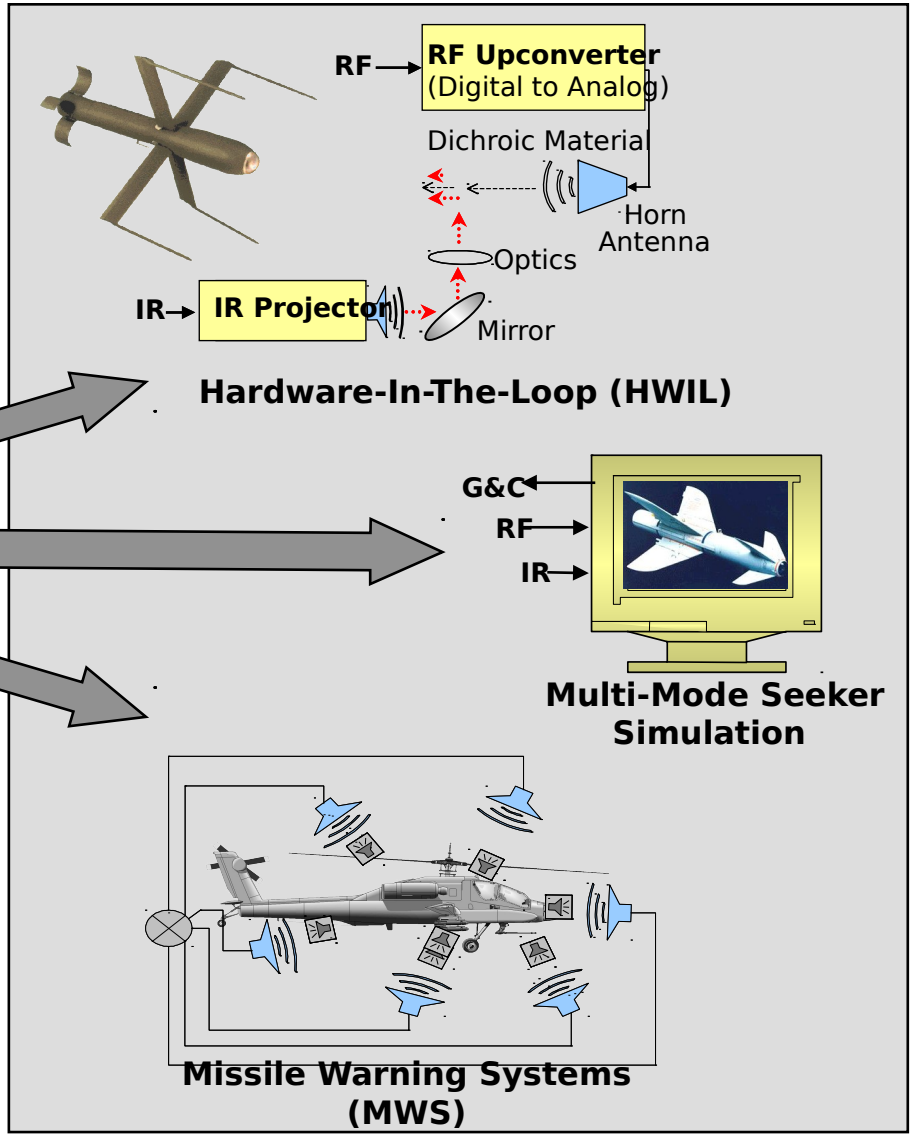
Developing technologies for an HEL redistribution system to reshape HEL beams to emulate far-field irradiance profiles in a near-field T&E environment

T&E/S&T Program
Multi-spectral Test Focus Area

- **Next-generation focal plane array sensors and seekers will operate through RF, UV, visible, and IR bands**
  - Need affordable processors to create scenes for T&E
  - Presentation options require wide dynamic range, fast frame rates, and realism
  - Need performance metrics that are based on scientific analysis and describe system attributes in operational terms
- **Need an end-to-end multi-spectral test capability**
  - Robust, scalable, and affordable
- **Supports T&E within DDR&E Initiative: Surveillance and Knowledge Systems**
  - Sensors and unmanned vehicles
- **4 active projects**



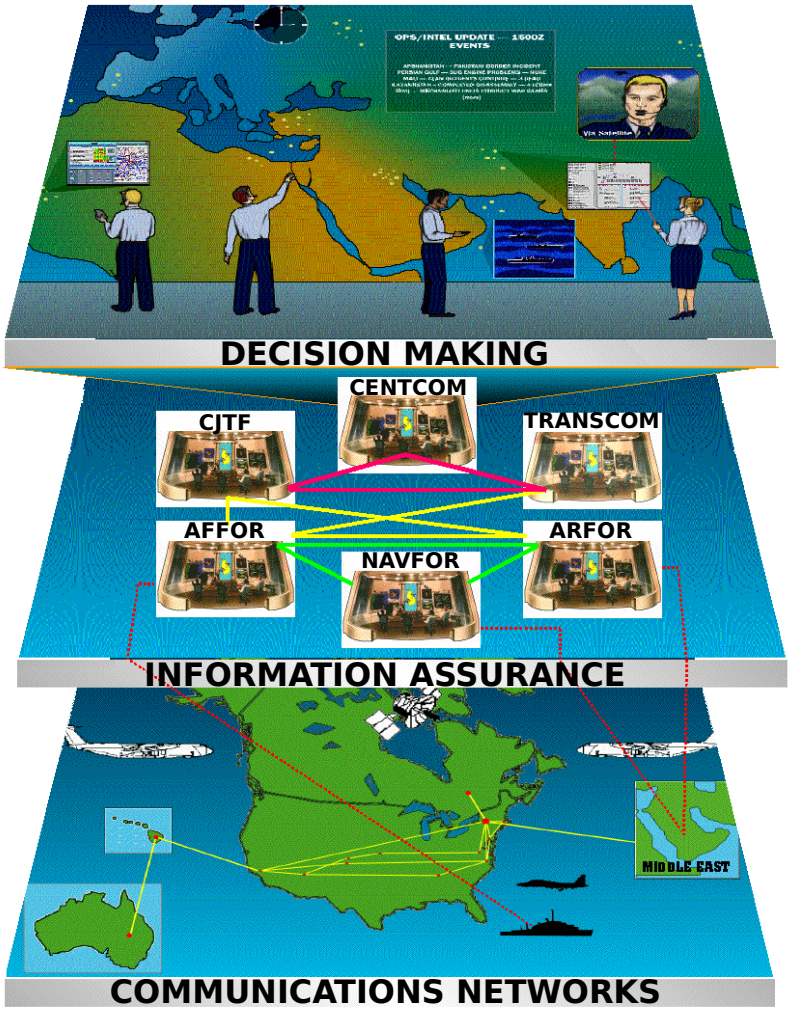
Multi-Spectral Stimulator Injection Test Method



Developing multi-spectral scene injection technology to provide interconnected RF & IR scene generators in synchronous and correlated operation to support T&E of multi-spectral sensor

T&E/S&T Program
Information Systems Technology (IST) Test Focus Area

- **Information systems are a "force multiplier" in U.S. military operations**
  - Command & Control
  - Operational Pictures/Intelligence, Surveillance & Reconnaissance (ISR)
- **Emerging, powerful information systems technologies—drive toward network centric warfare**
  - Information Assurance (IA) to protect computer networks, information, and information systems
  - Seamless, secure, self-organizing, self-healing, tactical and global communications networks
- **Need non-intrusive, IST test technologies**
  - Assess performance of networks of networks with multiplayer simultaneous activities
  - Evaluate the effectiveness of IA
  - Assess information/knowledge management
  - Test the functions of decision making systems, including the actions of intelligent agents
- **Supports T&E within DDR&E Initiative:**
  - Surveillance and Knowledge Systems
- **7 proposals under evaluation**



Information Systems Technology Test
FY2005 Broad Agency Announcement

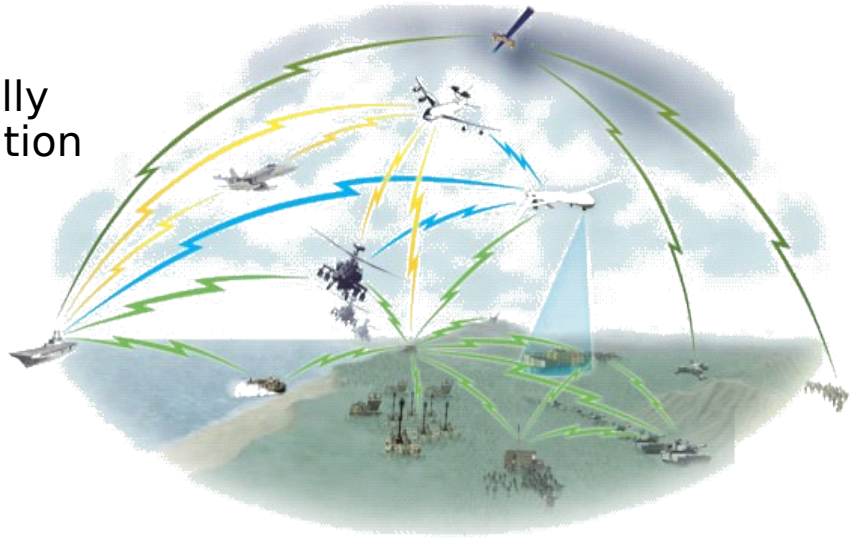
- BAA issued 20 Dec 2004
- BAA topics included technologies for T&E of
  - Communication Networks
  - Information Assurance (IA)
  - Composable Data Sources and Network Interactions
  - Decision Support

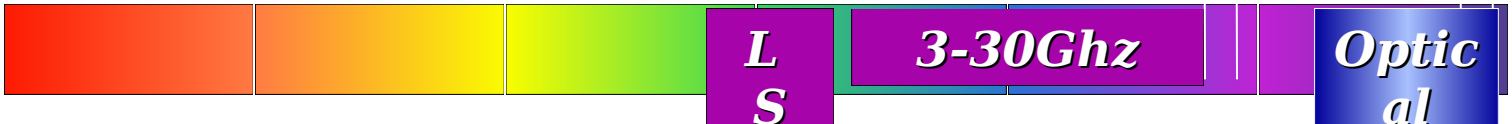
	Abstracts Submitted	Request for Proposal
DoD	8	2
Industry Prime	16	5
Academia Prime	1	0

- Proposals received on 15 March 2005
- Contract awards: April-May 2005

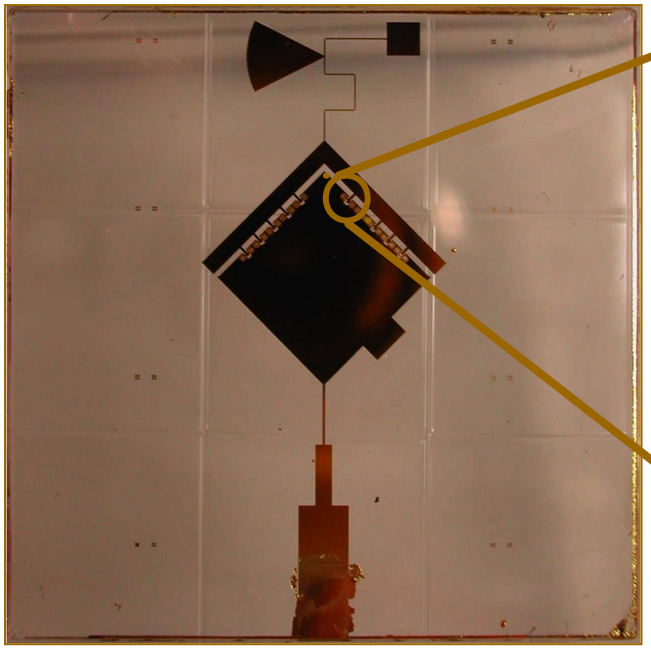
T&E/S&T Program
Spectrum Efficient Technology Focus Area

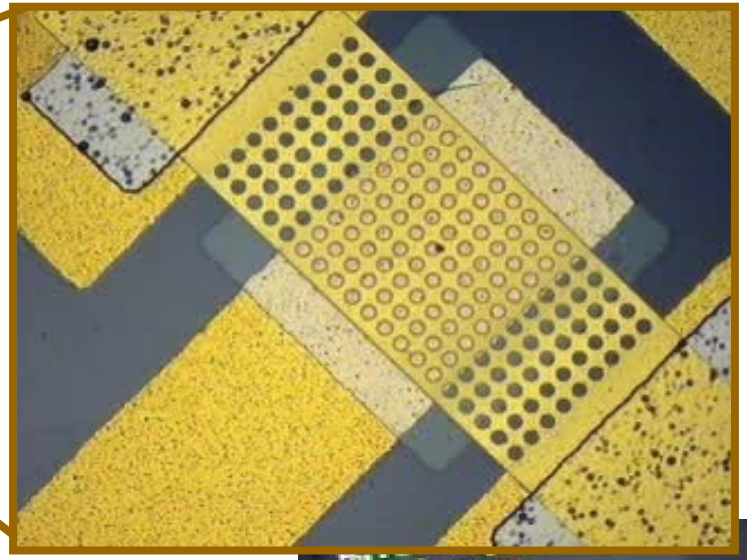
- **Growth in demand for consumer communication services**
  - Traditional bands for T&E (L and S), ideally suited for telemetry because of propagation and supportable data rates
  - Same bands desirable for commercial wireless comm
- **Each new generation of military systems generates over ten times more data than its predecessor**
  - F-15 development ~256 Kbps
  - F-22 development ~10 Mbps
- **Need more spectrum for T&E**
  - More efficient L and S band operations
  - Expand into Super High Frequency (SHF)
  - Explore Optical Band
- **DDR&E Initiative: Surveillance and Knowledge Systems**
  - High Band Width Communications/Information Assurance
- **10 active projects**

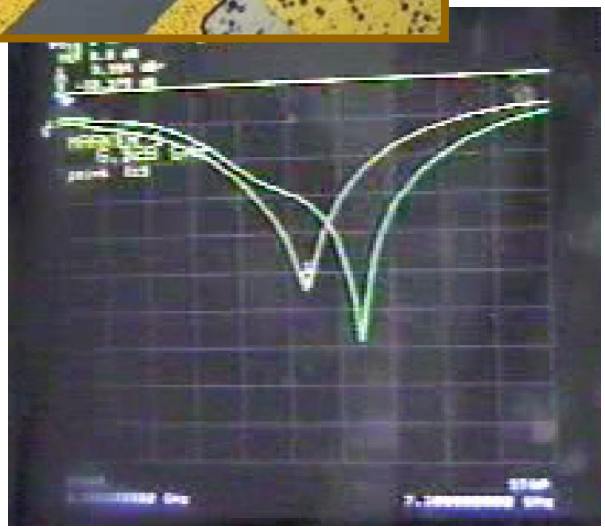




RF MEMS Antenna



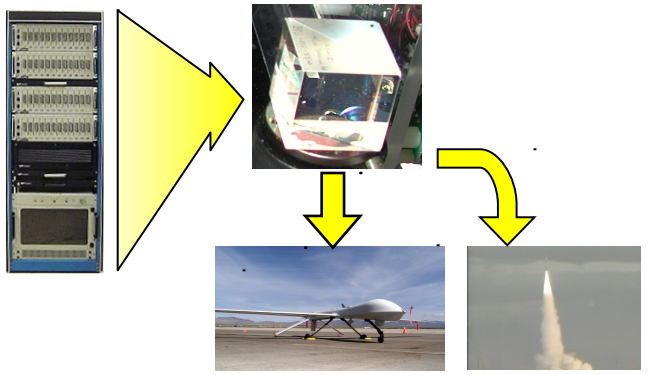


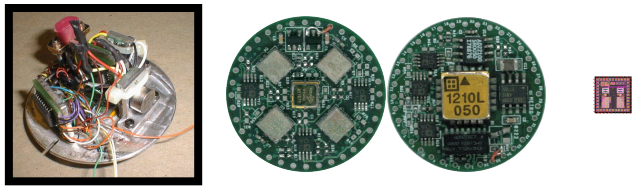


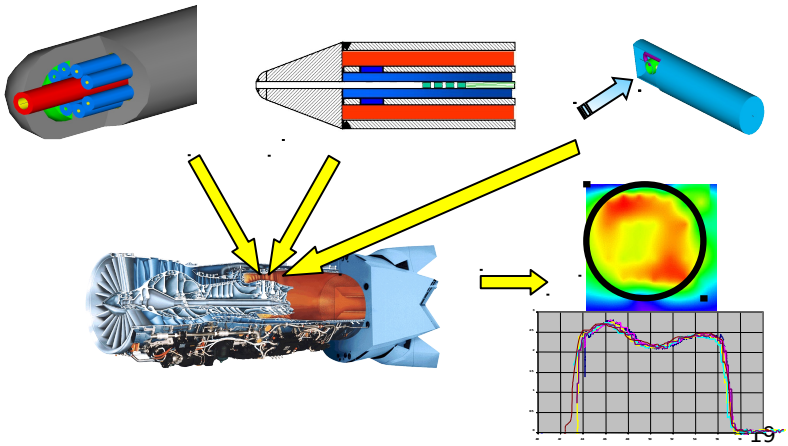
Developing microelectromechanical systems (MEMS) based antenna technology to support reconfigurable (software-defined) phased array antennas for aeronautical telemetry

T&E/S&T Program
Embedded Instrumentation (EI) Focus Area

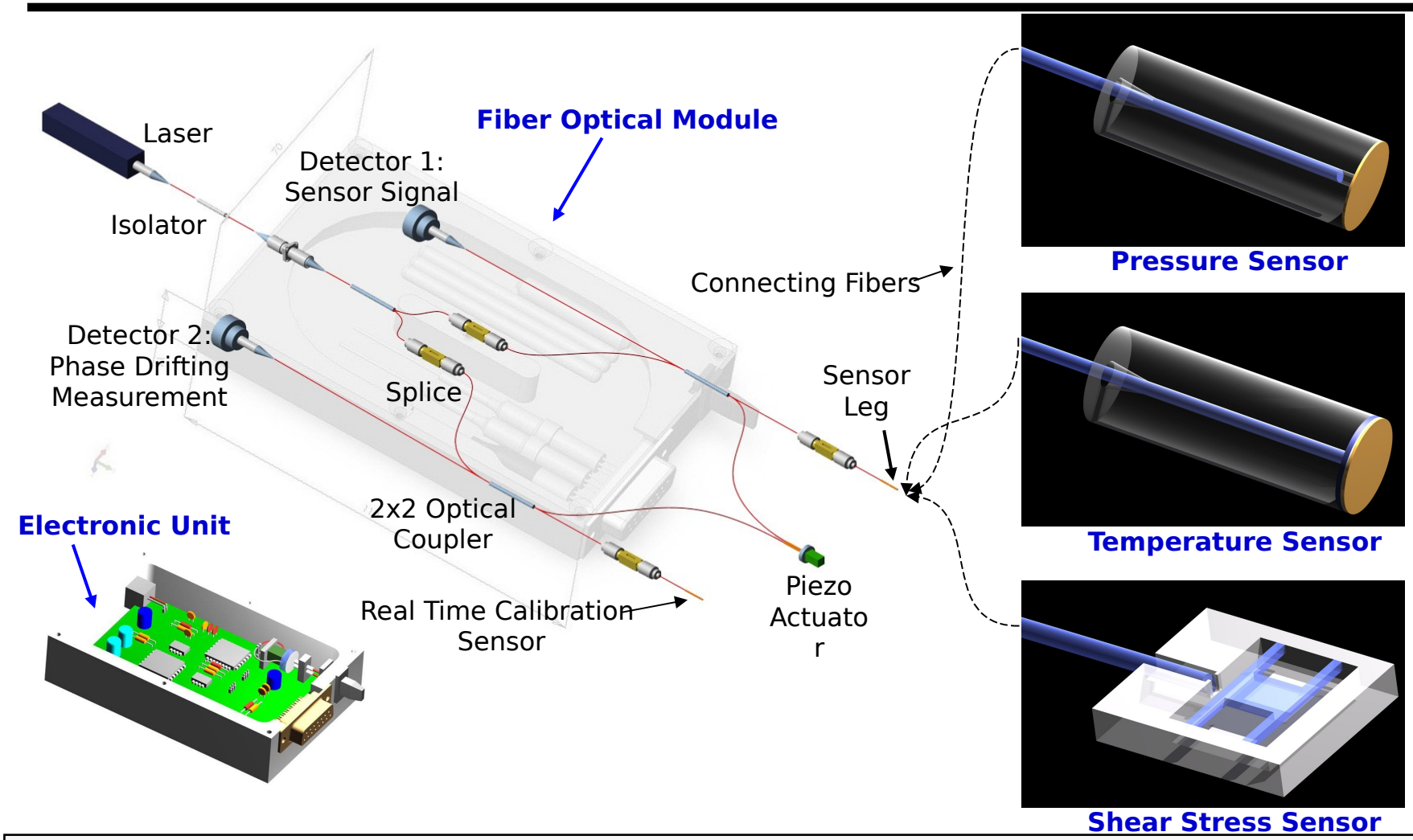
- **Military systems smaller, more capable, complex, interdependent, and interoperable**
  - Scarce space for sensors, wiring, and data processing and storage
  - Must minimize effects of instrumentation to the signature/ performance of the system-under-test
- **EI has the potential for providing cost savings and enhancing force readiness**
  - Key is to design EI in up front
  - CJCSI 3170.01C—The Initial Capabilities Document (ICD) and the Critical Development Document (CDD) must include consideration for EI
  - Director, J-6, Joint Staff will ensure that CDDs and Critical Production Documents (CPDs) include EI in systems tradeoff studies
- **Need technologies and architectures for non-intrusive, survivable instrumentation suites**
  - Both plug-and-play and open architectures
- **Supports T&E within DDR&E Initiatives:**
  - NAI
  - Surveillance and Knowledge Systems
  - Energy and Power Technologies
- **11 active projects**







MEMS Fiber Optic Sensors



Developing miniaturized embedded sensor technology to collect complete sets of pressure, temperature and shear stress data on a single sensor head module

T&E/S&T Program
Wrap Up

- **T&E/S&T program initiated to address critical T&E needs, tied to S&T drivers**
- **Sustained growth and demonstrated value**
  - Mature focus areas transitioning technology into test capabilities
- **Keys to continued success**
  - Participation of Services on Joint needs definition
  - Good mix of industry, laboratories and universities working on solutions
  - Participation of Services, industry, laboratories and universities to transition technologies to T&E capabilities

Shaping Technology into Tomorrow's T&E Capabilities